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WEST VIRGINIA UNIVERSITY
AGRICULTURAL EXPERIMENT STATION,
MORGANTOWN, W. VA.

BULLETIN 71. DECEMBER, 1900.

Poultry Experiments.

BY J. H. STEWART AND HORACE ATWOOD.

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[The Bulletins and Reports of this Station will be mailed free to any citizen of West Virginia upon written application. Address Director of Agricultural Experiment Station, Morgantown, W. Va.]

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POULTRY EXPERIMENTS.

Since issuing the last poultry bulletin, No. 60, the farm formerly owned by the Experiment Station has been sold, and upon the farm obtained in its place nine poultry houses have been erected. Although these houses have been built especially for experimental purposes, a brief description may be of interest.

The houses are ten feet wide and twenty feet long, and are arranged in a row facing southward so as to give the fowls as much sunlight as possible during the winter. In the front of each house is a door and two windows. The doors are furnished with spring locks, thus securely fastening the houses at all times. The windows are covered with wire netting and are kept open during the hot weather. These and a drop door on the east end of each house, also covered with wire netting. are the only means of ventilation. At the approach of very cold weather the windows and doors are closed and remain so until spring.

There are two runs for each house, and they are entered by the fowls through two drop doors in the rear of the houses. An advantage of having double runs is that the fowls are thus constantly supplied during the summer with an abundance of green food, the runs being plowed three or four times, and alternately planted to rape or some other suitable crop. During the planting, and while the crop is young, the adjacent run is opened and the fowls have free access to it, while the newly planted yard is closed by means of a little drop door. Each run is furnished with a wire gate opening out upon a board walk which extends in front of the houses and runs.

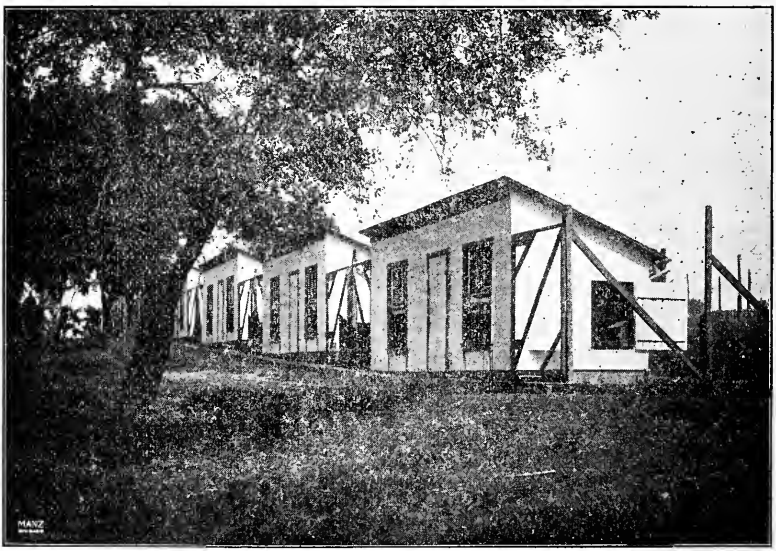
The houses rest upon brick foundations about two feet in height, a foot of which is above ground. The surface of the ground within this wall is filled up to the sills with sand and upon this is scat-

tered litter in which the fowls scratch during the winter for grain and grit.

A tile drain extending along the rear of the houses keeps the dirt floor of the houses dry in all kinds of weather.

The houses are divided into two rooms, a roosting room in which the roosts and nest boxes are situated, and a scratching pen. The perches are merely frames made from two-inch strips suspended from the rafters by wires. Under the perches are the platforms for the droppings which are also suspended from the rafters. Underneath these platforms are the nests.

The accompanying cuts show the general arrangement and appearance of the houses



In this bulletin are given the results of such experiments with poultry as have been completed during the past year.

THE IMPORTANCE OF WARM HOUSES IN THE PRODUCTION OF WINTER EGGS.

An examination of market reports shows that during the past five years strictly fresh eggs in the Pittsburg market have averaged to sell, in a wholesale way, for 9.3 cents more per dozen during the months of December, January, and February than during May, June, July, and August. The average price for the latter months has been only 11.5 cents per dozen. The advance from summer to winter prices has thus been over 80 per cent. and from a financial standpoint it is therefore wise to produce as many eggs as possible in the winter.

The experiment described below was designed to study the effect upon egg production of keeping the hens as warm as possible during the winter without the aid of artificial heat.

Two houses situated side by side and similar in all respects were selected for the experiment. They were each 20 feet long and 10 feet wide with a partition across the center dividing each house into a roosting room in which the roosts and nests were situated, and a scratching pen. The houses had been constructed with matched siding and with shingle roofs. Before the experiment began one house was sheeted on the inside with boards and then thoroughly papered so as to cover all of the cracks.

Twenty-four Rhode Island Red Pullets and two cocks were divided into two similar lots and placed in the houses prepared for them. They were supplied with mica crystal grit, granulated bone, and water at all times, and each flock was allowed a run 30 feet wide and 100 feet long. The two flocks were fed the same kind and amount of food. The experiment began November 24, 1899, and was continued for five periods of thirty days each. At the beginning of each period the fowls were weighed, and the food for that period was weigned and stored in suitable boxes in the scratching shed. At the end of each period the fowls and the remaining food were again weighed. The fowls were fed each morning a mash consisting of equal parts of corn meal, brown

middlings, and ground oats, and at night whole grain was scattered in the litter.

The following tables showing the food consumption, the weight of the fowls, and the number and weight of the eggs have been calculated for 100 fowls in each lot except in the case of the table showing the egg production, which has been calculated per hundred hens, the cocks being disregarded.

Table showing the amount of food consumed per hundred fowls during each period of thirty days:

FOOD.	Period 1.	Period 2.	Period 3.	Period 4.	Period 5.
Corn Meal	56.1	39.2	53.8	42.3	41.6
Brown Middlings	56.1	39.2	53.8	42 3	41.6
Ground Oats	56.1	39.2	53·8	42.3	41.6
Fresh Bone	128.8	65.4	71 1	38.4	29.1
Corn	.....	76.9	38.4	138.4	50.0
Wheat Screenings	407.7	138.4	.....	.....	.....
Wheat	.....	.....	253.8	111.5	120.8
Oats	123.0	88.4	53 8	153.8	212.5

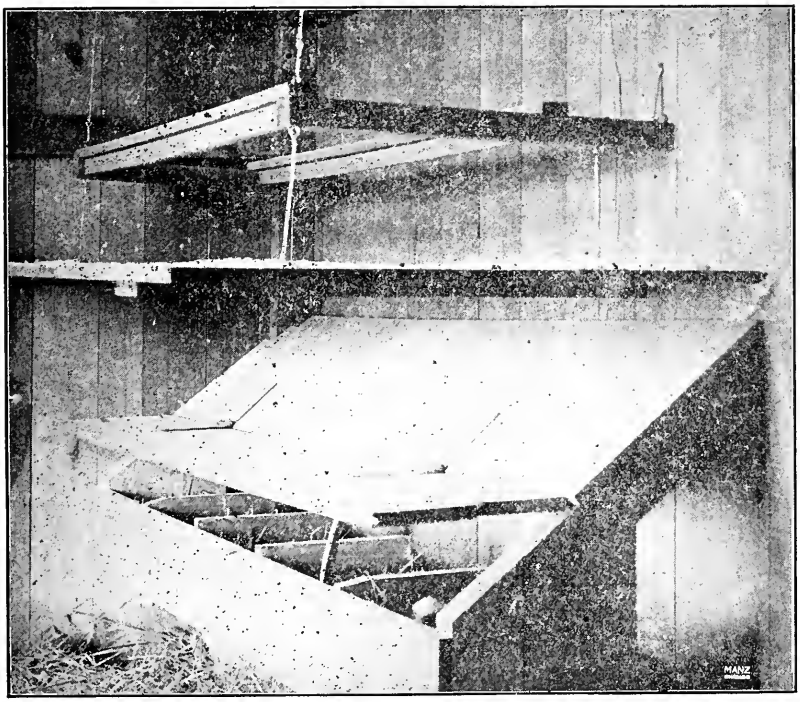
Table showing the number and weight of eggs produced per hundred hens during each period of the experiment:

FLOCK.	Period.	Number of Eggs.	Total Weight of Eggs.	Weight of 100 Eggs.
			lbs.	lbs.
Warm House	1	725	85 8	11.84
Cold House	1	425	56 6	13 33
Warm House	2	1083	131.2	12.11
Cold House	2	866	104.5	12 06
Warm House	3	1150	141.6	12.32
Cold House	3	858	107.5	12.52
Warm House	4	1000	122.9	12.29
Cold House	4	1033	127.3	12.37
Warm House	5	1281	154.1	12.02
Cold House	5	954	117.2	12.28

The total number of eggs produced per hundred hens in the warm house was 5,239, while the other flock laid only 4,136 eggs, during the five months of the test, leaving a balance in favor of the

warm house flock of 1,103 eggs, which were worth in our local market 24 cents per dozen, or $22.06. It is thus seen that the additional expense for increasing the warmth of the house was a very profitable investment.

This experiment clearly indicates that for the production of winter eggs it is highly important to build warm, substantial houses for the hens.



MEAT MEAL COMPARED WITH GROUND FRESH MEAT AND BONE FOR EGG PRODUCTION.

It is well known that ground fresh meat and bone is a very valuable constituent of a ration for egg production. In many localities, however, it is difficult to procure fresh bones and scraps from meat markets, and even when a supply is constantly available it is not usually an easy matter to grind the material for the fowls. On the other hand beef scraps and meat meal can be bought of the poultry supply houses at any time, and being in a thoroughly dry condition can be readily mixed with other feeding stuffs.

The experiment described below was undertaken for the purpose of comparing meat meal with ground fresh meat and bone as materials furnishing protein to laying hens.

Thirty-four Barred Plymouth Rock hens and two cocks were divided into two similar lots. They were supplied at all times with mica crystal grit, granulated bone, and water. The grain ration for each lot of fowls was the same, but the amount consumed varied somewhat, and so the actual amount of grain consumed by each lot is given. At the beginning of each period the grain for that period was weighed and stored in suitable boxes. No account was taken of the daily amounts fed. At the end of each period the amount remaining was again weighed, and the difference taken as the actual amount of food consumed.

The experiment began October 25, 1899, and was continued for four periods of thirty days each. The following tables show the various details of the experiment.

Table showing the amount and kind of food consumed by each lot of fowls during each of the four periods of the experiment. Calculated for 100 fowls in each lot:

LOT 1—MEAT MEAL.

Food.	Period 1.	Period 2.	Period 3.	Period 4.
Corn meal	83.3	50.0	44.4	63.5
Brown middlings	83.3	50.0	44.4	63.5
Ground oats	83.3	50.0	44.4	63.5
Meat meal	33.3	33.3	12.8	8 8
Corn			55.5	
Wheat	166.6			435.3
Oats	316.6	172.2	125.0	44.1
Wheat screenings		416.6	211.1	

LOT 2—GROUND BONE.

Food.	Period 1.	Period 2.	Period 3.	Period 4.
Corn meal	83.3	50 0	55.5	62.7
Brown middlings	83.3	50.0	55.5	62.7
Ground oats	83 3	50 0	55.5	62.7
Ground fresh bone	144.4	127.7	55.5	58.3
Corn			83.3	
Wheat	166.6			411.1
Oats	333 3	177.7	125.0	41.6
Wheat screenings		416.6	211 1	

The weight of the fowls at the beginning of the experiment and at the end of each period is shown in the following table, which has been calculated for 100 fowls in each lot:

Lot.	Original weight.	End of period 1.	End of period 2.	End of period 3.	End of period 4.
Meat meal	472.	555.	572	588.	575.
Fresh bone	472.	594.	616.	600.	591.

The fowls fed ground fresh bone gained more in weight than the lot receiving meat meal.

The following table shows the number, total weight, and weight per hundred of the eggs produced during each period of the experiment. The number and total weight of the eggs have been calculated for 100 hens in each lot:

Lot.		Period 1.	Period 2.	Period 3.	Period 4.
Meat meal..	Number of eggs.	500.	964.	853.	943.
	Total weight of eggs	57 6	117.0	103.5	113.1
	Weight of 100 eggs	11.53	12.13	12.13	11 98
Fresh Bone.	Number of eggs.	365.	1,094.	1,200.	1,164.
	Total weight of eggs	43.3	141.4	158.8	151.7
	Weight of 100 eggs	11.81	12.93	13.23	13.03

During the experiment the fowls receiving the fresh bone laid 3824 eggs weighing 495.2 lbs., of an average weight of 12.75 lbs. per hundred eggs, while the meat meal lot laid only 3260 eggs weighing 391.2 lbs. and weighing 11.94 lbs. per hundred. Consequently the fowls fed fresh bone not only gained more in weight but they also laid more and larger eggs.

During the experiment four of the hens receiving meat meal died and were replaced by others. At the time it was thought that they were killed by some poison present in the meat meal. The fowls receiving ground fresh meat and bone remained healthy during the entire test.

SUMMARY.—In this test the fowls fed ground fresh meat and bone laid more and larger eggs, increased more in weight and were healthier during the experiment than the fowls receiving meat meal. Of course with another sample of meat meal the results might have been different, and consumers are advised when purchasing meat meal or beef scraps to insist upon obtaining a perfectly fresh article.

NITROGENOUS FOOD FOR GROWING CHICKENS.

Very little careful work has been done to determine how nitrogenous or narrow a ration should be for growing chickens, and indeed it is quite probable that no general rule applicable to all cases can be determined, for possibly the ration best suited for the production of broilers, which are forced as rapidly as possible until they reach a suitable market size, may not be best for the production of breeders in which vigor and strength are prime essentials. In order to study this problem exhaustively, then, it would be necessary to consider the nutritive ratio of the rations best suited

to the requirements of these two branches of the poultry industry.

The feeding experiment described below is merely preliminary, and cannot be considered complete in any sense, nor is it of much value to the producers of poultry on a large scale, for most of these people have already recognized the great importance of an abundant supply of nitrogenous food for growing chickens. There are, however many small producers who, in the past, have not paid sufficient attention to this matter, and this experiment is reported with the object of attracting renewed attention to the importance of a narrow ration for young chickens.

Fifty White Wyandotte and White Leghorn chicks, most of them about two months old, were divided into two lots similar in respect to number, size and age, but as some of them were quite small it was impossible to distinguish the breed with certainty, and after the experiment had been under way for some time it was found that there were more White Leghorns in one lot than in the other. The fowls which received the carbonaceous ration consisted of 8 White Wyandotte cockerels, 13 White Leghorn pullets, and 4 White Wyandotte pullets. The other lot contained the same number of White Wyandotte cockerels, 9 White Leghorn pullets, and 8 White Wyandotte pullets, and although the weights of the two lots of fowls would probably have varied somewhat even though they had been fed the same ration on account of there being more fowls of the lighter breed in one pen than in the other, yet as the two rations had such a marked influence upon the health and development of the fowls, the experiment is of value even though the actual gain in weight of the two lots be disregarded.

The experiment began July 28th, 1899, and was divided into four periods of thirty days each. During the first three periods both flocks were confined in runs thirty feet wide and one hundred feet long, and during the fourth period both lots, in addition to the runs, were occasionally allowed to range in front of the poultry houses.

It was planned to continue feeding the same fowls the nitrogenous and carbonaceous rations after the pullets had begun to lay, and study the influence of the two rations upon egg produc-

tion, but shortly after the end of the fourth period several of the carbonaceous fowls died of roup, and as none of them were in a healthy, vigorous condition it was feared that the disease might spread to other pens and the experiment was discontinued. The carbonaceous fowls were then put upon a good wholesome diet and an immediate improvement in their condition was noticeable.

The chicks were fed each morning a mash consisting of ground feed moistened with water, and in the afternoon as much whole grain as they would eat up clean, corn predominating for the carbonaceous lot. Mica crystal grit, granulated bone, and pure water were supplied at all times.

The following table gives the kind and amount of food consumed during each thirty day period. Calculated for one hundred chicks in each flock.

	Corn Meal.	Brown Midd.	Ground Oats.	Ground Wheat.	Fresh Bone.	Corn.	Wheat.	Oats.
Pen 1, Period 1	.....	46.0	40.0	.....	72.0	.....	83.2	.....
" " 2	.....	54.0	56.0	.....	196.0	.....	172.0	.....
" " 3	.....	.....	47.0	66.0	144.0	82.0	240.0	.....
" " 4	56.8	.....	50.8	50.8	152.0	200.0	128.0	60.0
Pen 2, Period 1	70.0	.....	22.8	.....	.....	66.0	40.0	.....
" " 2	76.6	.....	48.0	.....	.....	100.0	60.0	.....
" " 3	89.0	.....	30.0	.....	.....	120.0	80.0	.....
" " 4	107.2	.....	53.6	.....	.....	84.0	120.0	60.0

The following table shows the original weight, and the grain made during each period. Calculated for one hundred chicks in each flock:

	Original weight.	Gain, Period 1.	Gain, Period 2.	Gain, Period 3.	Gain, Period 4.	Total Gain.
	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
Pen 1	92	56	88	46	118	308
Pen 2	98	36	20	48	88	192

The cost of the food for one pound increase in live weight for each of the four periods is shown below. The financial calculations are based upon the following schedule of prices:

Wheat.....$1.25 per cwt.
Oats ..... $1.00 " "
Wheat Bran $ .75 " "
Middlings.. $ .75 " "
Meat Meal.. $2.00 " "
Fresh bone $ .75 " "
Corn meal.. $ .85 " "
Corn ..... $,85 " "

Table showing the cost of the food consumed and the cost of one pound increase in live weight for each of the four periods:

	Period 1.	Period 2.	Period 3.	Period 4.	Total.
Pen 1, Cost of food	$2.32	$4.58	$6.07	$5.86	$18.84
Cost of one pound gain	.041	.052	.132	.049	* .061
Pen 2, Cost of food	1.88	2.72	3.07	4 26	11.94
Cost of one pound gain	.052	.136	.064	.048	* .062

*Average.

This table shows a remarkable variation in the cost of grain during the different periods, and is probably an illustration of the fact that care in feeding is at least of as much importance as the rations fed.

Observations Concerning the Test.—Neither ration had the proper composition for economical gains, one being too wide and the other too narrow. The influence of the food upon the health and development of the fowls was, however, very marked. The nitrogenous chicks were vigorous and hearty at all times, while the carbonaceous ones were sickly, poorly feathered, and had very little appetite for their food. A certain amount of animal protein seems to be necessary for poultry, and perhaps the poor development of the carbonaceous lot was caused as much by this factor as by the composition of the ration. Of the two breeds the White Leghorns seemed to be much better able to thrive on the carbonaceous ration than the White Wyandottes, for they were much better feathered, and more vigorous than the White Wyandottes in the same pen. The fact that the composition of the ration should depend to a certain extent upon the characteristics of the breed to which it is fed has been already observed. In an experi-

ment conducted at the New York Geneva Station, and described in the Eighth Annual Report, it was found that "The larger breeds did somewhat better on the nitrogenous ration, and the smaller breeds considerably better with the less nitrogenous." The whole subject of poultry feeding still needs much study.

THE IMPORTANCE OF AN ABUNDANCE OF GREEN FOOD FOR LAYING HENS.

During the past year the importance of a liberal supply of green food for laying hens has been studied with two flocks of White Leghorn fowls about five years old.

The experiment began July 14, 1899, and was continued for twelve periods of thirty days each. Forty White Leghorn hens and four cocks were divided into two similar flocks and placed in two houses situated side by side. Both flocks were allowed runs 15 feet wide and 100 feet long, and both lots of fowls had access at all times to the grass and other herbage growing in their respective runs. For the first five periods pen 1 received an abundance of cabbage, rape and apples in addition to the grass of the run. During the next three periods the green food was given to pen 2 instead of pen 1, then for two periods pen 1 again received green food, and finally during the last two periods of the test the green food was furnished to pen 2. This alteration was for the purpose of overcoming any possible variation in the original egg producing capacity of the two flocks.

During the entire experiment both lots of fowls received the same kind of food and the same attention. Each morning they were fed a mash of ground feed consisting of equal parts of brown middlings, corn meal and ground oats, and at night whole grain was scattered in the litter. They were also supplied with granulated bone and mica crystal grit.

The following table, calculated for one hundred fowls in each flock, gives the total amount of food consumed during the twelve months of the test:

FOOD CONSUMED BY FOWLS WHEN RECEIVING GREEN FOOD.

Corn Meal.	Brown Midd.	Ground Oats.	Beef scraps.	Fresh bone.	Corn.	Wheat.	Oats.	Buck-wheat.	Wheat screenings	Apples, Rape, Cabbage.
644.1	385.0	504.1	31.6	714.6	983.6	1164.5	852.4	88.6	431.7	1959.2

FOOD CONSUMED BY FOWLS WHEN RECEIVING NO GREEN FOOD.

Corn meal.	Brown midd.	Ground Oats.	Beef scraps.	Fresh bone.	Corn.	Wheat.	Oats.	Buck-wheat.	Wheat screenings.
646.9	386.5	505.1	37.8	706.7	1122.4	1201.4	1018.0	86.3	431.7

The fowls when receiving green food consumed during the test 5800 pounds of grain, beef scraps and ground fresh bone, or 58 pounds per fowl, while the other lot consumed 6142 pounds of these materials, or 61 pounds per fowl, showing that the feeding of cabbage, rape, and apples affected a slight saving of grain.

The weight of the fowls was not influenced materially by the abundance of green food. Each flock was weighed at the beginning and end of each period. The average weight during the year, of the fowls when receiving green food was 3.89 pounds, while those when not receiving green food weighed 3.86 pounds.

The following table shows the number, weight, and weight per hundred, of the eggs produced during each period of the experiment. Calculated for 100 hens in each lot.

FOWLS WHEN RECEIVING GREEN FOOD.

	Number of eggs.	Weight of eggs.	Weight of 100 eggs.
		Pounds.	*Pounds.*
Period 1	660	74.5	11.28
2	680	76.5	11.25
3	945	112.5	11.90
4	1,020	122.0	11.96
5	675	83.5	12.37
6	290	35.7	12.32
7	330	42.0	12.72
8	930	114.0	12.26
9	1,595	201.5	12.63
10	1,600	185.7	11.61
11	1,542	174.4	11.31
12	1,185	131.2	11.07
Total	11,452	1,353.5	
Average weight of 100 eggs			11.89

FOWLS WHEN NOT RECEIVING GREEN FOOD.

	Number of eggs.	Weight of eggs.	Weight of 100 eggs.
		Pounds.	*Pounds.*
Period 1	710	79.5	11.19
2	865	96.0	11.09
3	610	70.0	11.47
4	710	81.5	11.48
5	385	45.5	11.81
6	355	44.2	12.46
7	90	12.0	13.33
8	735	96.0	13.06
9	975	117.0	12 00
10	994	118.8	11.24
11	1,400	158.6	11.33
12	1,210	147.2	12.16
Total	9,039	1,066.3	
Average weight of 100 eggs			11.88

An inspection of the table shows that the fowls while receiving green food laid 11452 eggs weighing 1353.5 pounds, while the other lot laid only 9039 eggs weighing 1066.3 pounds, leaving a balance in favor of the green food fowls of 2413 eggs, or at the rate of two dozen eggs per hen.

It is seen that the size of the eggs was not changed, as the average weight for the entire year was 11.89 pounds per hundred eggs for the green food fowls, and 11.88 pounds per hundred for the other lot.

SUMMARY.—During the 360 days each fowl when liberally supplied with green food consumed 58 Pounds of beef scraps, ground fresh bone, and grain. During the same time fowls which did not receive green food consumed 61 pounds of the same materials.

White Leghorn fowls which were at least five years old laid 114 eggs each when supplied with an abundance of green food and only 90 eggs when not supplied with green food.

In view of the fact that in practice the presence or absence of green food would exert its greatest influence in winter when eggs are highest in price, it would seem very important to supply fowls during that season with some kind of green food, and in summer to allow them a run sufficiently large so that there will be an abundance of succulent vegetable matter for them at all times.

AN EXPERIMENT CONCERNING THE UNFERTILITY OF EGGS.

In the spring of 1900 about 25 per cent. of the eggs produced by the fowls at the Station Farm were unfertile; of the fertile eggs only about 65 per cent. would hatch, and the chickens which were produced were not strong and vigorous. The eggs were principally laid by pullets which had been used during the winter in various experiments concerning egg production. The fowls had been kept in flocks of twenty in laying houses, and had been fed quite heavily on a well balanced ration.

Whole grain was scattered in the litter in the houses at night, and in addition to the exercise of scratching for their grain each flock was allowed a run 15 feet wide and 100 feet long. The hens and cocks were apparently vigorous and plenty of eggs were obtained but they would not hatch well.

The experiment began March 11th when a flock of White Leghorn fowls was selected to study the influence of unrestricted range upon the hatching of the eggs. One half of the flock was allowed to remain undisturbed in the house and yard to which it was accustomed, while the remainder of the flock was allowed to run at large. Both lots of fowls were fed the same grain ration, but it was observed that the fowls running at large did not consume as much food as those confined, which was probably due to the larger number of bugs and worms which they were able to

find. Both lots of fowls received ground fresh meat and bone and those confined had an abundance of green food.

About six weeks after the experiment began eggs were collected from each lot of fowls, marked, placed in the same incubator and hatched side by side. The following table gives the details of the three hatches which were made.

Table showing the influence of abundant exercise upon the hatching of eggs:

CYPHER'S INCUBATOR.—STARTED APRIL 21, 1900.

Pen.	Number of eggs put in.	Per cent. of the eggs tested out on the 7th day.	Per cent. of the fertile eggs which hatched.
Free range	122	10.6	82.5
Confined	80	22.5	66.1

VICTOR INCUBATOR.—STARTED APRIL 30, 1900.

Pen.	Number of eggs put in.	Per cent. of the eggs tested out on the 7th day.	Per cent. of the fertile eggs which hatched.
Free range	80	7.5	86.4
Confined	64	21.8	82.0

CYPHER'S INCUBATOR.—STARTED MAY 12, 1900,

Pen.	Number of eggs put in.	Per cent. of the eggs tested out on the 7th day.	Per cent. of the eggs which hatched.
Free range	66	7.5	80.3
Confined	31	29.0	54.5

AVERAGE OF THE THREE TESTS.

Pen.	Per cent. of the eggs tested out on the 7th day.	Per cent. of the fertile eggs which hatched.
Free range	8.5	83.0
Confined	24.4	67.5

The average of the three tests shows that about three times as many of the eggs laid by the confined hens were unfertile, and

that the fertile eggs did not hatch so well as in the case of the fowls allowed unrestricted range.

NOTICE.

Application for bulletins of this Station should be addressed to the Director of the West Virginia Agricultural Experiment Station, Morgantown, W. Va.

(The bulletins named below are available for distribution.)

No. 4. The Creamery Industry; Its Adaptability to West Virginia

No. 5. The Selection of Milch Cows.

No. 14. Farm and Garden Insects and Experiments with Remedies; Notes of the Season.

No. 15. Raspberry Gouty-Gall Beetle.

No. 16. Yellow Locust, Insect Ravages upon.

No. 17. Black Spruce, Insect Ravages.

No. 19. Your Weeds and Your Neighbor's, Part 1. Weeds as Fertilizers.

No. 25. Plat Experiments with Commercial Fertilizers on Wheat.

No. 27. Notes on Pruning.

No. 28. Plat Experiments with Commercial Fertilizers on Corn.

No. 29. Experiments with Potatoes at the Station. Experiments on Corn at the Out Stations.

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